ERRATA TO ACCOMPANY NBS TECHNICAL NOTE 1106

FRAME C: A Compact Procedure for Quantitative Energy-Dispersive Electron Probe X-ray Analysis

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The attached pages are to be substituted for pages 87 - 105 in the text.

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APPENDIX 3

FRAME C

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100  REM    THIS PROGRAM READS STANDARD SPECTRA FROM QUADRANT 2
120  GOSUB  1000
130  PRINT "ENTER NO. OF ELEMENTS"
135  INPUT N
140  PRINT
141  CALL 4,(1)
142  CALL 4,(3)
143  IF  FNA(2)= 0 GOTO  146
144  LET E0= FNA(2)/1000
145  GOTO  151
146  PRINT "ENTER E0 (YOUR TOA IS";M3;"DEG)"
147  INPUT E0
148  LET E1=(E0+.00001)*1000
149  LET L1= FNC(2)
150  CALL 3,L1,E1
151  LET L1= FNC(3)
152  CALL 3,L1, 0
154  CALL 4,(3)
155  CALL 4,(1)
160  LET Z[N]=4
170  LET Z[N+1]=14
180  LET Z[N+2]=79
181  PRINT
185  PRINT "ENTER CON, ATNO, LINE CODE AND VALENCE FOR EACH"
190  FOR I= 0 TO N+2
200    IF I>N-1 GOTO  230
210    INPUT C[I],Z[I],L[I],Q[I]
220    PRINT
230    LET L9=1
240    GOSUB  1500
250    IF L[I]= 0 GOTO  280
260    LET L9=2
270    GOSUB  1500
274    IF  FNG(I)>=1 GOTO  280
275    PRINT "LINE OF ";Z[I];" BELOW 1 KV"
276    GOTO  380
280  NEXT I
285  GOSUB  8000
290  LET N3= 0
291  CALL 4,(1)
292  CALL 4,(3)
293  LET L1= FNC(5)
294  CALL 3,L1,K1*10000
295  CALL 4,(3)
296  CALL 4,(1)
300  GOSUB  3000
310  GOSUB  2200
312  CALL 4,(1)
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316  CALL 4,(3)
320  GOSUB  5100
330  FOR I= 0 TO N-1
335    LET M[I]=W[I]
340  NEXT I
352  CALL 4,(3)
356  CALL 4,(1)
360  GOSUB  5500
370  GOSUB  2700
380  STOP
390  END
500  REM   THIS PROGRAM READS A SPECIMEN SPECTRUM FROM QUADRANT 1
501  REM        THE STANDARDS INFORMATION FROM QUADRANT 4 AND PRINTS
502  REM    QUANTITATIVE RESULTS. A1, B1 AND DISPLAY ON.
520  GOSUB  1000
530  CALL 4,( 0)
550  CALL 4,(3)
570  LET N9= FNA(1)
575  LET N4= FNA(3)
576  LET L1= FNC(3)
577  CALL 3,L1,1
579  IF N4=1 GOTO  595
580  PRINT "ENTER NO. OF ELEMENTS"
590  INPUT N
591  LET L1= FNC(4)
592  CALL 3,L1,N
595  LET E0= FNA(2)/1000
596  LET N= FNA(4)
600  PRINT
610  LET Z[N]=4
620  LET Z[N+1]=14
630  LET Z[N+2]=79
635  IF N4=1 GOTO  650
640  PRINT "ENTER AT. NO. FOR EACH ELEMENT"
650  FOR I= 0 TO N+2
660    IF I>=N GOTO  680
665    IF N4=1 GOTO  675
670    INPUT Z[I]
671    LET L1= FNC(900+I)
672    CALL 3,L1,Z[I]
673    GOTO  680
675    LET Z[I]= FNA(900+I)
680    LET L9=1
690    GOSUB  1500
700    IF I>=N GOTO  800
710    FOR J=10 TO N9 STEP 10
720      IF  FNA(J)=Z[I] GOTO  750
730    NEXT J
740    GOTO  800
750    LET L[I]= FNA(J+1)
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760     LET Q[I]= FNA(J+2)
770     LET L9=2
780     GOSUB  1500
790     GOTO  810
800     LET L[I]= 0
810   NEXT I
815   PRINT
820   CALL 4,(3)
840   CALL 4,( 0)
855   GOSUB  8000
860   LET N3=3
865   IF N4=1 GOTO  880
870   GOSUB  3000
880   GOSUB  5500
890   STOP
900   END
1000   REM         THIS SUBROUTINE READS IN COEFFICIENTS FOR COMPUTING
1001   REM    ENERGIES, ABSORPTION EDGE RATIOS, ATOMIC WEIGHTS,
1002   REM    KB/K RATIOS, AND ELECTRON INCIDENCE AND X-RAY
1003   REM    EMISSION ANGLES
1005   DIM C[12],Z[12],L[12],Q[12],E[8,12],G[16,12]
1006   DIM M[12],W[12],X[3],Y[3],U[12],F[3,12],S[16,12]
1007   DIM O[12,12],H[24,12],V[12,12],P[12,12]
1010   DIM K[8,2],T[16,2],R[9],A[92],B[50]
1020   DEF  FNA(I)= DTA ((I- LCN (118))/ LCN (120))
1025   DEF  FNE(I)= ECL ((I- LCS (134))/ LCS (136))
1030   DEF  FNC(I)=(I- LCN (118))/ LCN (120)
1035   DEF  FNN(I)=1000*(I- FNE( 0))/( FNE(1000)- FNE( 0))
1036   DEF  FNL(I)=2.905* SQR (I)-3.063
1037   DEF  FNJ(I)=9.76*I+58.5*I^(-.19)
1038   DEF  FNF(I)=.2567*I-6.8176
1039   DEF  FNM(I)= EXP (34.165*I-30.027* SQR (I)+8.5268)/1.6
1040   FOR I= 0 TO 9
1050     READ R[I]
1060   NEXT I
1070   DATA  1, 1, 1.17, 1.63, 1, 1.16, 1.4, 1.621, 1.783, 1
1080   FOR J= 0 TO 2
1090     FOR I= 0 TO 8
1100       READ K[I,J]
1110     NEXT I
1120   NEXT J
1130   DATA -3.97931E-2,-.033916,-8.65397E-2,-.228343, 1.25179
1140   DATA  .834903, .442217, .25141, .272951
1150   DATA  2.423, 2.82526, 3.32315, 4.31172,-7.838
1160   DATA -4.14925,-.979241, .931913, .688906
1170   DATA  5.5091, 9.03526, 10.2505, 12.0025,-11.5803
1180   DATA -3.33802, 3.15348, 8.03561, 7.4243
1190   FOR J= 0 TO 2
1200     FOR I= 0 TO 16
1210       READ T[I,J]
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```
1220    NEXT I
1230  NEXT J
1240  DATA -1.99726E-2,-.123941,-.47555,-.060101
1242  DATA -.117102,-.192466,-.197431,-3.22523E-3, .035676
1244  DATA  2.88553E-3, 9.57107E-2, .092961, 5.05888E-2
1246  DATA -.390705,-.386042,-.603132, .322877
1250  DATA  2.22412, 3.29533, 6.84662, 2.52781
1252  DATA  3.22414, 3.83158, 4.01718, 2.48613, 2.29113
1254  DATA  2.49221, 1.69157, 1.7559, 2.0035
1256  DATA  6.17432, 6.14822, 7.75598, .102358
1260  DATA  5.17774, 9.75836, 20.0833, 5.6437
1262  DATA  9.58711, 10.9293, 11.3323, 8.37742, 8.09392
1264  DATA  8.60965, 6.76302, 6.81839, 7.30182
1266  DATA  19.0119, 18.7034, 21.4878, 5.58269
1270  FOR I=11 TO 30
1280    READ B[I]
1290  NEXT I
1300  DATA  .011, .027, .04, .055, .066, .078, .085, .097
1310  DATA  .108, .114, .115, .117, .119, .119, .121
1311  DATA  .121, .121, .123, .1235, .125
1320  FOR I=1 TO 92
1330    READ A[I]
1340  NEXT I
1350  DATA  1.008, 4.003, 6.94, 9.013, 10.82, 12.011
1351  DATA  14.007, 16, 19, 20.18
1360  DATA  22.99, 24.31, 26.98, 28.09, 30.97, 32.06
1361  DATA  35.45, 39.95, 39.1, 40.08
1370  DATA  44.96, 47.9, 50.94, 52, 54.94, 55.85
1371  DATA  58.93, 58.71, 63.54, 65.37
1380  DATA  69.72, 72.59, 74.92, 78.96, 79.91
1381  DATA  83.8, 85.47, 87.62, 88.91, 91.22
1390  DATA  92.91, 95.94, 99, 101.1
1391  DATA  102.9, 106.4, 107.9, 112.4, 114.8, 118.7
1400  DATA  121.8, 127.6, 126.9, 131.3, 132.9, 137.3, 138.9
1401  DATA  140.1, 140.9, 144.2
1410  DATA  145, 150.4, 152, 157, 158.9, 162.5
1411  DATA  164.9, 167.3, 168.9, 173
1420  DATA  175, 178.5, 180.95, 183.85, 186.2
1421  DATA  190.2, 192.2, 195.1, 196.97
1430  DATA  200.6, 204.4, 207.2, 209, 210, 210
1431  DATA  222, 223, 226, 227, 232
1432  DATA  231, 238
1440  LET M3=40
1450  LET Q2=90
1454  LET P6=9.165E-4
1455  LET P7=8.579E-6
1460  LET Q1=1/ SIN (M3/57.2958)
1470  LET Q2= SIN (Q2/57.2958)
1480  LET Q3=149
1485  LET Q3=Q3^2-14737.5
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1490  DEF  FNS(I)= SQR (2500*I+Q3)*4.2466E-4
1492  DEF  FNG(I)=G[L[I]-1,I]
1495  RETURN
1500  REM    THIS SUBROUTINE COMPUTES ALL OF THE NECESSARY
1501  REM    EDGE AND LINE ENERGIES
1520  LET Z1= LOG (Z[I])
1530  IF L9=2 GOTO  1580
1540  FOR M1= 0 TO 8
1550    LET E[M1,I]= EXP (K[M1, 0]*Z1*Z1+K[M1,1]*Z1-K[M1,2])
1560  NEXT M1
1570  IF L9=1 GOTO  1610
1580  FOR M1= 0 TO 16
1590    LET G[M1,I]= EXP (T[M1, 0]*Z1*Z1+T[M1,1]*Z1-T[M1,2])
1600  NEXT M1
1610  RETURN
1700  REM    THIS SUBROUTINE COMPUTES ALL MASS ABSORPTION
1701  REM    COEFFICIENTS REQUIRED
1710  DIM D[3,3]
1720  LET D[ 0, 0]=-.232229
1730  LET D[ 0,1]=-.254471
1740  LET D[ 0,2]=.256216
1750  LET D[ 0,3]=1.35917
1760  LET D[1, 0]=4.07005
1770  LET D[1,1]=4.76925
1780  LET D[1,2]=1.15119
1790  LET D[1,3]=-9.49212
1800  LET D[2, 0]=-6.22075
1810  LET D[2,1]=-10.3788
1820  LET D[2,2]=-5.68485
1830  LET D[2,3]=18.6408
1840  LET D[3,2]=2.6
1850  LET D[3,3]=2.22
1860  LET Z1= LOG (Z[I])
1870  LET D[3, 0]= EXP (-4.5522E-3*Z1*Z1-6.8535E-3*Z1+1.07018)
1880  LET D[3,1]=2.73
1890  IF Z[I]<42 GOTO  1910
1900  LET D[3,1]= EXP (-.11316*Z1*Z1+.836883*Z1-.545969)
1910  FOR M1= 0 TO 9
1920    LET M3=M1+1
1930    IF M1=9 GOTO  1945
1940    IF E1<E[M1,I] GOTO  1970
1945    LET L1=M1- INT (M3/3)- INT (M3/4)- INT (M3/7)
1950    LET C2= EXP (D[ 0,L1]*Z1*Z1+D[1,L1]*Z1+D[2,L1])/R[M1]
1955    LET A1=C2*(12.398/E1)^D[3,L1]
1960    GOTO  1980
1970  NEXT M1
1980  RETURN
2000  REM        THIS SUBROUTINE COMPUTES THE DETECTOR EFFICIENCY
2010  LET I=N
2020  GOSUB  1700
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2030  LET A3=A1*1.82*P6
2040  LET I=N+2
2050  GOSUB  1700
2060  LET A4=A1*19.3*8E-7
2070  LET I=N+1
2080  GOSUB  1700
2090  LET D2= EXP (-A3-A4-A1*2.33*P7)*(1- EXP (-A1*2.33*.469))
2095  RETURN
2100  REM    THIS SUBROUTINE COMPUTES THE ABSORPTION FACTOR
2101  REM    FOR ANY LINE
2110  LET X3=A2*Q1
2120  LET G1=(E0^1.65-E1^1.65)*Q2
2130  LET F1=1/(1+1.2E-6*G1*X3)^2
2140  RETURN
2200  REM    THIS SUBROUTINE COMPUTES BACKGROUND UNDER EACH PEAK
2220  FOR I= 0 TO 1
2230    LET M[I]= ROI (I)/( LCN (158)- LCN (157))
2240    LET W[I]= FNE(( LCN (157)+ LCN (158))/2)
2250  NEXT I
2260  FOR J= 0 TO 1
2270    LET A2= 0
2280    LET E1=W[J]
2290    FOR I= 0 TO N-1
2300      GOSUB  1700
2310      LET A2=A2+C[I]*A1
2320    NEXT I
2330    GOSUB  2000
2340    GOSUB  2100
2350    LET T1=D2*F1/E1
2360    LET X[J]=E0-E1
2370    LET Y[J]=M[J]/T1
2380    LET U[J]=X[J]*X[J]
2390  NEXT J
2400  LET D1=X[ 0]*U[1]-U[ 0]*X[1]
2410  LET K1=(Y[1]*X[ 0]-Y[ 0]*X[1])/D1
2420  LET K2=(Y[ 0]*U[1]-Y[1]*U[ 0])/D1
2425  IF L[ 0]=10 GOTO  2620
2430  FOR J= 0 TO N-1
2440    IF L[J]= 0 GOTO  2610
2450    LET J1=L[J]-1
2460    LET E1=G[J1,J]
2470    LET T5= ROI (J+2)
2480    LET A2= 0
2490    FOR I= 0 TO N-1
2500      GOSUB  1700
2510      LET A2=A2+C[I]*A1
2520    NEXT I
2530    GOSUB  2000
2540    GOSUB  2100
2550    LET T1=D2*F1/E1
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2560    LET X1=E0-E1
2570    LET G1=T1*(K1*X1*X1+K2*X1)
2580    LET G2= LCN (158)- LCN (157)
2590    LET M[J]=T5-G1*G2
2600    LET F[1,J]=F1
2610  NEXT J
2620  RETURN
2700  REM    THIS SUBROUTINE WRITES STANDARDS INFORMATION INTO
2701  REM         QUADRANT 4.
2710  CALL 4,(1)
2730  CALL 4,(3)
2750  LET N9= FNA(1)
2760  FOR I= 0 TO N-1
2770    IF L[I]= 0 GOTO  2850
2780    LET N9=N9+10
2790    LET L1= FNC(N9)
2800    CALL 3,L1,Z[I]
2810    LET L1= FNC(N9+1)
2820    CALL 3,L1,L[I]
2830    LET L1= FNC(N9+2)
2840    CALL 3,L1,M[I]
2842    LET L1= FNC(N9+3)
2843    CALL 3,L1,Q[I]
2850  NEXT I
2860  LET L1= FNC(1)
2870  CALL 3,L1,N9
2880  CALL 4,(3)
2900  CALL 4,(1)
2920  RETURN
3000  REM    THIS SUBROUTINE COMPUTES OVERLAP FUNCTION OF ONE
3001  REM         PEAK ON ANOTHER.
3010  LET G4= 0
3015  IF N3> 0 GOTO  3025
3017  CALL 4,(1)
3020  GOTO  3027
3025  CALL 4,( 0)
3027  CALL 4,(3)
3029  FOR I=300 TO 899
3030    LET L1= FNC(I)
3031    CALL 3,L1, 0
3032  NEXT I
3034  FOR I= 0 TO N-1
3035    IF L[I]= 0 GOTO  3200
3040    LET E7= FNG(I)
3050    LET S6= FNS(E7)
3052    LET T5= ROI (I+2)
3056    LET E3= FNE( LCN (157))
3060    LET E4= FNE( LCN (158))
3070    LET X2=(E3-E7)/S6/1.4142
3080    GOSUB  4500
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3085    GOSUB  4200
3090    LET E1= ABS (E8)/2
3100    LET X2=(E4-E7)/S6/1.4142
3110    GOSUB  4500
3120    LET E2= ABS (E8)/2
3130    IF E3<=E7 GOTO  3160
3140    LET W[I]=E2-E1
3150    GOTO  3195
3160    IF E4>=E7 GOTO  3190
3170    LET W[I]=E1-E2+G4
3180    GOTO  3195
3190    LET W[I]=E1+E2+G4
3195    LET M[I]=W[I]
3200  NEXT I
3205  FOR K1= 0 TO 1
3230    FOR I1= 0 TO N-1
3240      IF L[I1]= 0 GOTO  3390
3245      LET J1= 0
3250      LET T5= FNG(I1)
3260      LET D3=4* FNS(T5)
3270      LET I=N+1
3280      LET S6= ROI (I1+2)
3290      LET E3= FNE( LCN (157))
3300      LET E4= FNE( LCN (158))
3310      FOR J= 0 TO N-1
3320        IF L[J]= 0 GOTO  3350
3325        IF K1=1 GOTO  3340
3330        IF J=I1 GOTO  3340
3335        GOTO  3350
3340        LET X2=1/ LOG (E0*E0/E[3,J]/E[8,J])
3345        GOSUB  3500
3350      NEXT J
3360      IF K1=1 GOTO  3390
3381      FOR J= 0 TO 16
3382        LET L1= FNC(I1*20+700+J)
3384        LET O2=S[J,I1]*100000
3385        IF O2> 0 GOTO  3387
3386        LET O2= 0
3387        CALL 3,L1,O2
3389      NEXT J
3390    NEXT I1
3395  NEXT K1
3400  CALL 4,(3)
3410  IF N3= 0 GOTO  3440
3420  CALL 4,( 0)
3430  GOTO  3450
3440  CALL 4,(1)
3450  RETURN
3490  REM     COMPUTE OVERLAPS FOR EACH LINE
3500  LET O2= 0
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```
3501  LET X[1]= EXP (2.373* LOG (Z[J])-8.902)
3502  LET X[2]= EXP (2.946* LOG (Z[J])-13.94)
3503  LET X[3]=2.27E-5*Z[J]^2-.001359*Z[J]-.00657
3504  FOR L2= 0 TO 8
3505    LET M1=L2+1
3506    LET I2=M1- INT (M1/3)- INT (M1/4)- INT (M1/7)
3507    LET M3=2*( INT (M1/I2)- INT (M1/6)+ INT (M1/7))
3508    IF E[L2,J]>=E0 GOTO  3513
3509    LET E1=E0/E[L2,J]
3510    LET E2=1166*E[L2,J]/ FNJ(Z[J])
3511    LET X1=E1*E2
3512    LET U[M1]=M3*(E1-1- LOG (E2)/E2*( FNL(X1)- FNL(E2)))*X[I2]
3513  NEXT L2
3514  LET A4=1
3515  LET A5=1
3516  LET A1=1
3517  LET A2=1
3518  LET A3=1
3519  IF L[J]=3 GOTO  3530
3520  IF L[J]=2 GOTO  3525
3521  LET A2=U[4]/U[1]* FNF(Z[J])
3522  LET A4=U[2]/U[1]* FNF(Z[J])
3523  LET A5=U[3]/U[1]* FNF(Z[J])
3524  GOTO  3533
3525  LET A1=U[1]/U[4]/ FNF(Z[J])
3526  LET A3= FNM(X2)
3527  LET A4=U[2]/U[4]
3528  LET A5=U[3]/U[4]
3529  GOTO  3533
3530  LET A2=1/ FNM(X2)
3531  LET A4=U[2]/U[4]/ FNM(X2)
3532  LET A5=U[3]/U[4]/ FNM(X2)
3533  LET S[ 0,J]=A1
3534  IF Z[J]>50 GOTO  3540
3535  LET R1=B[Z[J]]
3536  IF Z[J]<=30 GOTO  3538
3537  LET R1=.115*( LOG (Z[J])-2.3)
3538  LET S[3,J]=R1/(1-R1)*A1
3540  LET S[1,J]=A2
3550  LET S[2,J]=A3
3571  LET S[4,J]=.1*A2
3572  LET S[5,J]=.044*A2
3573  LET S[6,J]=(.2808-.0016*Z[J])*A2
3574  LET S[7,J]=A5
3575  LET S[8,J]=.154*A5
3576  LET S[9,J]=.02*A5
3577  LET S[10,J]=.166*A4
3578  LET S[11,J]=.068*A4
3579  LET S[12,J]=.104*A4
3602  LET S[13,J]=.06*A3
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```
3603  LET S[14,J]=.5*A3*U[8]/U[9]
3604  LET S[15,J]=.05*A3*U[7]/U[9]
3605  LET S[16,J]=.01*A3*U[6]/U[9]
3625  IF I1=J GOTO  3730
3630  LET E7= FNG(J)
3640  LET S6= FNS(E7)
3642  FOR I2= 0 TO 16
3643    IF S[I2,J]> 0 GOTO  3645
3644    LET S[I2,J]= 0
3645  NEXT I2
3730  FOR I2= 0 TO 16
3740    LET E7=G[I2,J]
3742    IF T5=E7 GOTO  3840
3744    IF E7<1 GOTO  3840
3746    IF E7>E0 GOTO  3840
3750    LET S6= FNS(E7)
3760    IF E7<T5-D3 GOTO  3840
3770    IF E7>T5+D3 GOTO  3820
3780    GOSUB  4000
3805    IF K1= 0 GOTO  3815
3810    LET O2=O1/W[J]*S[I2,J]
3812    GOSUB  3855
3814    GOTO  3840
3815    IF I2=L[J]-1 GOTO  3840
3816    LET W[J]=W[J]+O1*S[I2,J]
3819    GOTO  3840
3820    LET S8= 0
3825    GOSUB  3900
3830    LET O2=O1/W[J]*S8*S[I2,J]
3835    GOSUB  3855
3840  NEXT I2
3850  RETURN
3855  LET O2= INT (O2*100000)
3860  IF O2= 0 GOTO  3886
3861  LET E9= 0
3862  LET X2=J
3864  GOTO  3876
3866  LET E9=1
3868  LET X2=I2
3870  GOTO  3876
3872  LET E9=2
3874  LET X2=O2
3876  LET L1= FNC(I1*40+300+E9+J1)
3878  CALL 3,L1,X2
3880  IF E9= 0 GOTO  3866
3882  IF E9=1 GOTO  3872
3884  LET J1=J1+3
3886  RETURN
3890  REM     COMPUTE ESCAPE PEAKS
3900  IF E7<1.838 GOTO  3990
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```
3903  LET E1=E7
3905  LET E7=E7-1.74
3910  IF T5<E7-D3 GOTO  3990
3920  IF T5>E7+D3 GOTO  3990
3940  GOSUB  1700
3950  LET S7=.5*(1-327.9/A1* LOG (1+A1/327.9))
3960  LET S8=.038*S7/(1-.038*S7)
3970  LET S6= FNS(E7)
3980  GOSUB  4000
3990  RETURN
4000  REM      THIS FUNCTION COMPUTES SPECIFIC OVERLAPS
4010  LET X2=(E3-E7)/S6/1.4142
4020  GOSUB  4500
4025  GOSUB  4200
4030  LET E2= ABS (E8)/2
4040  LET X2=(E4-E7)/S6/1.4142
4050  GOSUB  4500
4055  LET E8= ABS (E8)/2
4060  IF E3>=E7 GOTO  4100
4070  IF E4<=E7 GOTO  4120
4080  LET O1=E2+E8+G4
4090  RETURN
4100  LET O1=E8-E2
4110  RETURN
4120  LET O1=E2-E8+G4
4130  RETURN
4200  REM        THIS FUNCTION COMPUTES AN INCOMPLETE CHARGE
4201  REM        CORRECTION FOR ALL PEAKS.
4210  LET G4= 0
4220  LET X1=6
4230  LET X3=.1
4240  IF E7>=6.4 GOTO  4300
4250  LET X1=.86166*E7*E7-7.4431*E7+18.342
4260  LET X3=-.01683*E7*E7+.14129*E7-.11489
4270  IF X3<= 0 GOTO  4400
4300  IF E3>=E7 GOTO  4400
4310  LET X2=(E3-E7)/X3
4320  LET G4=X1*X3*X3*(1- EXP (X2)*(1-X2))
4330  IF E4>=E7 GOTO  4400
4340  LET X2=(E4-E7)/X3
4350  LET G4=G4-X1*X3*X3*(1- EXP (X2)*(1-X2))
4400  RETURN
4500  REM    THIS FUNCTION INTEGRATES AREA UNDER A GAUSSIAN PEAK
4510  LET T1=2^(-27)
4520  IF X2= 0 GOTO  5070
4530  LET Y1= ABS (X2)
4540  LET Y2=Y1*Y1
4550  IF Y1<=1 GOTO  4630
4560  LET C1=2^(3.5)
4570  LET U1=.83*C1
```

```
4580  LET S1=2^(C1*C1-8)
4590  IF Y1<=U1 GOTO  4770
4600  LET E8=1
4610  LET E9= 0
4620  GOTO  4730
4630  LET S2= 0
4640  LET D1=1
4650  LET T2=1
4660  LET P2=2*Y2
4670  LET D1=D1+2
4680  LET T2=P2*T2/D1
4690  LET S2=T2+S2
4700  IF T2>=T1 GOTO  4670
4710  LET E8=(S2+1)*1.12838*Y1* EXP (-Y2)
4720  LET E9=1-E8
4730  IF X2>= 0 GOTO  4760
4740  LET E8=-E8
4750  LET E9=2-E9
4760  RETURN
4770  LET F2= 0
4780  LET G2=1
4790  LET F1=2*Y1
4800  LET G1=2*Y2+1
4810  LET P3=F1/G1
4820  LET W1=1
4830  LET B1=G1+4
4840  LET A5=-W1*(W1+1)
4850  LET F3=B1*F1+A5*F2
4860  LET G3=B1*G1+A5*G2
4870  LET F4=F3/G3
4880  IF  ABS (1-F4/P3)<=T1 GOTO  5040
4890  IF P3>F4 GOTO  5030
4900  IF G3<S1 GOTO  4950
4910  LET F3=F3/S1
4920  LET G3=G3/S1
4930  LET F1=F1/S1
4940  LET G1=G1/S1
4950  LET F2=F1
4960  LET G2=G1
4970  LET F1=F3
4980  LET G1=G3
4990  LET W1=W1+2
5000  LET B1=B1+4
5010  LET P3=F4
5020  GOTO  4840
5030  LET F4=P3
5040  LET E9=F4* EXP (-Y2)*1.12838/2
5050  LET E8=1-E9
5060  GOTO  4730
5070  LET E8= 0
```

```
5080  LET E9=1
5090  RETURN
5100  REM         THIS SUBROUTINE CORRECTS PEAKS FOR OVERLAP USING
5101  REM         PREVIOUSLY COMPUTED OVERLAP FACTORS.
5110  FOR J= 0 TO N-1
5120    IF L[J]= 0 GOTO  5230
5140    LET A2= 0
5146    LET E1= FNG(J)
5147    GOSUB  2000
5148    FOR I= 0 TO N-1
5150      GOSUB  1700
5152      LET A2=A2+C[I]*A1
5154    NEXT I
5156    GOSUB  2100
5158    LET F[3,J]=F1*D2
5220    LET W[J]=M[J]
5230  NEXT J
5240  FOR T1= 0 TO 2
5250    FOR B1= 0 TO N-1
5255      IF L[B1]= 0 GOTO  5370
5260      LET R1= 0
5265      LET J=B1*40+300
5270      FOR D1= 0 TO 26 STEP 3
5275        LET L2= FNA(J+D1)
5285        LET G1= FNA(J+D1+1)
5290        LET Y1= FNA(J+D1+2)/100000
5292        IF Y1= 0 GOTO  5360
5295        LET E1=G[G1,L2]
5300        LET A2= 0
5305        GOSUB  2000
5310        FOR I= 0 TO N-1
5315          GOSUB  1700
5320          LET A2=A2+C[I]*A1
5325        NEXT I
5330        GOSUB  2100
5340        LET R1=R1+F1*D2*W[L2]*Y1/F[3,L2]
5350      NEXT D1
5360      LET W[B1]=M[B1]-R1
5370    NEXT B1
5380  NEXT T1
5390  RETURN
5500  REM    THIS SUBROUTINE COMPUTES THE MATRIX CORRECTIONS FOR
5501  FOR J= 0 TO 12
5502    FOR I= 0 TO 12
5503      LET P[I,J]= 0
5504    NEXT I
5505  NEXT J
5510  FOR J= 0 TO N-1
5520    IF L[J]= 0 GOTO  6400
5530    LET B1=L[J]^2-1
```

```
5540    IF B1<9 GOTO  5560
5550    LET B1= 0
5560    LET U[J]=E0/E[B1,J]
5570    IF U[J]>=1.5 GOTO  5590
5580    PRINT "OVERVOLTAGE TOO LOW"
5590    LET E1= FNG(J)
5600    FOR I= 0 TO N-1
5610      GOSUB  1700
5620      LET H[I,J]=A1
5630    NEXT I
5750    LET A2=H[J,J]
5760    GOSUB  2100
5770    LET F[ 0,J]=F1
5780    IF L[J]>1 GOTO  5820
5790    LET C1=5
5800    LET F3= 0
5810    GOTO  5890
5820    IF L[J]>2 GOTO  5860
5830    LET C1=3.5
5840    LET F3=1
5850    GOTO  5890
5860    IF L[J]>3 GOTO  5790
5870    LET C1=3.5
5880    LET F3=2
5890    FOR I1= 0 TO N-1
5900      IF I1=J GOTO  6160
5910      LET P3= 0
5920      LET L2=(P3+1)^2-1
5930      IF 1.02*E[L2,I1]-E0>= 0 GOTO  6130
5940      IF G[P3,I1]<E[B1,J] GOTO  6160
5950      IF G[P3,I1]>E[B1,J]+C1 GOTO  6130
5960      LET P[J,I1]=P3+1+2*F3
5970      LET O[J,I1]=E0/E[L2,I1]
6030      LET E1=G[P3,I1]
6040      FOR I= 0 TO N-1
6050        GOSUB  1700
6060        LET H[I+13,I1]=A1
6070      NEXT I
6120      GOTO  6160
6130      IF P3=1 GOTO  6160
6140      LET P3=1
6150      GOTO  5920
6160    NEXT I1
6170    FOR I= 0 TO N-1
6180      IF P[J,I]= 0 GOTO  6381
6190      LET Y1=A[Z[J]]/A[Z[I]]*H[J+13,I]/2*((O[J,I]-1)/(U[J]-1))^1.6

6200      LET T1= EXP (2.373* LOG (Z[I])-8.902)
6210      LET T2= EXP (2.946* LOG (Z[I])-13.94)
6220      IF P[J,I]>1 GOTO  6250
```

```
6230     LET D1=.88*T1
6240     GOTO  6380
6250     IF P[J,I]>2 GOTO  6280
6260     LET D1=3.696*T2
6270     GOTO  6380
6280     IF P[J,I]>3 GOTO  6310
6290     LET D1=.18*T1
6300     GOTO  6380
6310     IF P[J,I]>4 GOTO  6340
6320     LET D1=.75*T2
6330     GOTO  6380
6340     IF P[J,I]>5 GOTO  6370
6350     LET D1=.01*T1
6360     GOTO  6380
6370     LET D1=.01*T2
6380     LET O[J,I]=D1*Y1
6381   NEXT I
6382   LET U1=U[J]
6383   IF U1<=10 GOTO  6385
6384   LET U1=10
6385   LET G1=.00873*U1^3-.1669*U1*U1+.9662*U1+.4523
6386   LET G2=.002703*U1^3-.05182*U1*U1+.302*U1-.1836
6387   LET P2=.887-3.44/U1+9.33/U1^2-6.43/U1^3
6392   FOR I= 0 TO N-1
6394     LET V[I,J]=G1-G2* LOG (P2*Z[I]+25)
6395     LET S[I,J]=2*Z[I]/(A[Z[I]]*(E0+E[B1,J]))
6396     LET S[I,J]=S[I,J]* LOG (583*(E0+E[B1,J])/ FNJ(Z[I]))
6398   NEXT I
6400 NEXT J
6405 LET G4= 0
6410 IF N3= 0 GOTO  6550
6417 PRINT "NO PLOT ENTER 0"
6418 INPUT G4
6420 LET S1= 0
6425 PRINT
6430 FOR I= 0 TO N-1
6440   IF L[I]= 0 GOTO  6480
6450   LET M[I]= ROI (I+2)
6460   LET M[I]=M[I]/Q[I]
6470   LET S1=S1+M[I]
6480 NEXT I
6490 IF L[N-1]> 0 GOTO  6520
6500 LET C[N-1]=1-S1
6510 LET S1=1
6520 FOR I= 0 TO N-1
6530   LET C[I]=M[I]/S1
6540 NEXT I
6550 FOR N1= 0 TO N3
6560   FOR I1= 0 TO N-1
6570     IF L[I1]= 0 GOTO  6880
```

```
6580      LET S2= 0
6590      LET X2= 0
6600      LET A2= 0
6610      FOR J= 0 TO N-1
6620        LET S2=S2+C[J]*S[J,I1]
6630        LET X2=X2+C[J]*V[J,I1]
6640        LET A2=A2+C[J]*H[J,I1]
6650      NEXT J
6660      LET E1= FNG(I1)
6670      GOSUB  2100
6680      LET W1=(V[I1,I1]*S2)/(S[I1,I1]*X2)
6690      LET F[1,I1]=F1
6700      LET F2= 0
6710      FOR J= 0 TO N-1
6720        IF P[I1,J]= 0 GOTO  6810
6730        LET A3= 0
6740        FOR I= 0 TO N-1
6750          LET A3=A3+C[I]*H[I+13,J]
6760        NEXT I
6770        LET X1=Q1*A2/A3
6780        LET B1=(333000/(E0^1.65-E1^1.65))/A3*Q2
6790        LET F4= LOG (1+X1)/X1+ LOG (1+B1)/B1
6800        LET F2=F2+C[J]*O[I1,J]/A3*F4
6810      NEXT J
6815      IF C[I1]= 0 GOTO  6880
6820      LET G3=C[I1]/W1*(1+F2)*F[1,I1]/F[ 0,I1]
6830      IF N3> 0 GOTO  6870
6835      IF L[I1]= 0 GOTO  6880
6840      LET M[I1]=M[I1]/G3
6850      PRINT "MELS =";G3
6860      GOTO  6880
6870      LET G2=M[I1]*C[I1]
6872      LET C[I1]=G2*(1-G3)/(G2+G3*(1-M[I1]-C[I1]))
6874      IF N1<N3 GOTO  6880
6875      IF G4= 0 GOTO  6880
6876      GOSUB  8200
6880    NEXT I1
6890    IF N3= 0 GOTO  7110
6900    LET S1= 0
6910    FOR I= 0 TO N-1
6915      IF L[I]= 0 GOTO  6930
6916      IF C[I]> 0 GOTO  6920
6917      LET C[I]= 0
6920      LET S1=S1+C[I]
6930    NEXT I
6940    IF L[N-1]> 0 GOTO  6970
6950    GOSUB  8600
6970    IF N1=N3 GOTO  7050
6980    GOSUB  2200
6982    CALL 4,( 0)
```

```
6986    CALL 4,(3)
6990    GOSUB  5100
6992    CALL 4,(3)
6996    CALL 4,( 0)
7000    FOR I= 0 TO N-1
7010      IF L[I]= 0 GOTO  7040
7020      LET M[I]=W[I]/Q[I]
7030      LET C[I]=C[I]/S1
7040    NEXT I
7050  NEXT N1
7060  PRINT "Z","C","F(X)","K"
7070  FOR I= 0 TO N-1
7075    IF L[I]= 0 GOTO  7085
7080    PRINT Z[I],C[I],F[1,I],M[I]
7082    GOTO  7090
7085    PRINT Z[I],C[I]
7090  NEXT I
7100  PRINT "TOTAL =";S1
7105  CALL 4,(2)
7110  FOR I= 0 TO 1
7120    LET T5= ROI (I)
7130    PRINT "ROI";I, FNE( LCN (157)); FNE( LCN (158))
7140  NEXT I
7150  RETURN
8000  REM    SUBROUTINE TO CREATE A ROI FOR EACH MEASURED LINE
8010  LET L1=644
8015  LET K2=1
8020  LET K1=1.1775
8030  FOR I= 0 TO N-1
8040    IF L[I]= 0 GOTO  8130
8045    LET K2=K2+1
8046    LET I1=L[I]-1
8050    LET S1= FNS(G[I1,I])
8060    LET E1= FNN(G[I1,I]-K1*S1)
8070    LET E2= FNN(G[I1,I]+K1*S1)
8075    CALL 1,101,K2
8080    CALL 1,L1,E1
8090    LET L1=L1+1
8100    CALL 1,L1,E2
8110    LET L1=L1+1
8120    CALL 5
8130  NEXT I
8140  RETURN
8200  REM        THIS ROUTINE RECONSTRUCTS PEAKS IN QUADRANT 3
8210  LET T5=G3*Q[I1]/F[3,I1]
8230  CALL 4,(3)
8240  LET K2= FNA(5)/10000
8250  LET E1= FNG(I1)
8260  LET S1= FNS(E1)
8270  LET E3= FNN(E1-K2*S1)
```

```
8280  LET E4= FNN(E1+K2*S1)
8290  LET G1= 0
8300  LET E2=1
8305  LET S2=S1
8310  GOSUB  8500
8315  LET T5=T5/G1*S1
8320  FOR K1= 0 TO 16
8330    LET E1=G[K1,I1]
8340    IF E1<.7 GOTO  8450
8345    IF E1>10 GOTO  8450
8350    LET S2= FNS(E1)
8355    LET E3= FNN(E1-4*S2)
8360    LET E4= FNN(E1+4*S2)
8365    LET S6= FNA(700+20*I1+K1)/100000
8370    IF S6= 0 GOTO  8450
8375    LET E2=T5/S2*S6
8380    LET A2= 0
8385    FOR I= 0 TO N-1
8390      GOSUB  1700
8395      LET A2=A2+C[I]*A1
8400    NEXT I
8405    GOSUB  2000
8410    GOSUB  2100
8415    LET E2=E2*D2*F1
8425    CALL 4,(2)
8430    GOSUB  8500
8435    CALL 5
8440    CALL 4,(2)
8445    CALL 4,(3)
8450  NEXT K1
8460  CALL 4,( 0)
8470  RETURN
8500  FOR J=E3 TO E4
8505    IF J>1023 GOTO  8590
8510    LET J1= FNE(J)
8520    LET T1=E2* EXP (-.5* ABS ((J1-E1)/S2)^2)
8530    IF E2>1 GOTO  8560
8540    LET G1=G1+T1
8550    GOTO  8590
8560    LET L1= FNC(J)
8570    LET T1=T1+ FNA(J)
8580    CALL 3,L1,T1
8590  NEXT J
8595  RETURN
8600  REM      STOICHIOMETRY CALC
8605  LET C[N-1]= 0
8610  CALL 4,( 0)
8620  CALL 4,(3)
8630  FOR I= 0 TO N-2
8640    FOR J=10 TO N9 STEP 10
```

```
8650       IF  FNA(J)=Z[I] GOTO  8670
8660     NEXT J
8665     PRINT "ELEMENT ";Z[I];" NOT FOUND"
8667     STOP
8670     LET G3= FNA(J+3)
8675     IF G3= 0 GOTO  8720
8680     LET F3=.5*C[I]*G3*A[Z[N-1]]/A[Z[I]]
8690     LET C[N-1]=C[N-1]+F3
8700   NEXT I
8702   LET S1=S1+C[N-1]
8704   CALL 4,(3)
8705   CALL 4,( 0)
8710   RETURN
8720   LET C[N-1]=1-S1
8730   LET S1=1
8740   RETURN
```

```
100   REM      THIS ROUTINE COMPUTES THE THICKNESS OF THE BE WINDOW
102   REM  AND THE THICKNESS OF THE SI DEAD LAYER
130   GOSUB  1000
135   PRINT "ENTER AT. NO. AND E0"
140   INPUT Z[ 0],E0
141   PRINT
142   LET L[ 0]=10
143   LET N9=1
144   LET N=1
145   LET Z[N]=4
146   LET Z[N+1]=14
147   LET Z[N+2]=79
148   FOR I= 0 TO N+2
149     GOSUB  1500
150   NEXT I
151   LET C[ 0]=1
152   FOR P2= 0 TO 14
154     GOSUB  2200
155     FOR I=2 TO 3
160       LET M[I]= ROI (I)/( LCN (158)- LCN (157))
170       LET W[I]= FNE(( LCN (157)+ LCN (158))/2)
180     NEXT I
181     FOR J=2 TO 3
185       LET I= 0
190       LET E1=W[J]
200       GOSUB  1700
210       LET A2=A1
220       GOSUB  2100
230       LET T1= LOG (F1/E1)
240       LET G1= LOG (M[J])
250       LET X1=E0-E1
260       LET I=N
270       GOSUB  1700
274       LET X[J-2]=A1*1.82
275       LET I=N+1
276       GOSUB  1700
280       LET Y[J-2]=A1*2.33
285       LET I=N+2
290       GOSUB  1700
291       LET A3=A1*19.3*8E-7
292       LET U[J-2]= LOG (K1*X1*X1+K2*X1)-G1+T1-A3
293     NEXT J
294     LET D1=X[ 0]*Y[1]-Y[ 0]*X[1]
295     LET P6=(U[ 0]*Y[1]-U[1]*Y[ 0])/D1
296     LET P7=(X[ 0]*U[1]-X[1]*U[ 0])/D1
300     PRINT "T BE=";P6;"T SI=";P7
310   NEXT P2
312   PRINT "INSERT THESE VALUES INTO LINES 1454 AND 1455"
320   STOP
390   END
```